For instance, where each conducting element is a Zener diode (or a series combination of Zener diodes), the voltage across each insulating region will be limited to the breakdown voltage of the Zener diode.

Alternatively, each conducting element may be a resistor, and the voltage control device may be a potential divider that defines the voltage of each intermediate semiconductor region. Providing a controlled current leakage path in parallel with each insulating region means that the voltage across each insulating region is defined.

The voltage control device may be at least partly defined in at least one of: the first semiconductor region, an intermediate semiconductor region and the second semiconductor region. For instance, a conducting element (e.g. a Zener diode) may be formed in each intermediate region, and a further conducting element formed in either (or both of) the first or second region, thereby providing a conducting element corresponding with each insulating region.

The first and second semiconductor region may be defined in the same semiconductor layer. The semiconductor layer may comprise: a bulk semiconductor material (e.g. silicon), a silicon on insulator layer or a semiconductor on insulator layer.

Each non-conducting region may comprise a trench isolation structure. The trench isolation structure may be through a full thickness of the semiconductor layer. Such an arrangement may be particularly suitable for high voltage applications.

Each conducting element may comprise a resistor. Each conducting element may have a relatively high resistance, so as to limit any current leakage when a voltage bias exists between the first and second region.

Each conducting element may comprise a diode, or a plurality of diodes connected in series. The threshold voltage of a single diode may be below the limit voltage of the dielectric region.

The voltage divider may comprise a plurality of diodes. A diode under reverse bias exhibits a breakdown voltage at which the current suddenly increases due to at least one of the Zener effect or avalanche breakdown effect. Diodes may therefore be used to limit the voltage step between the first end of the voltage divider and the intermediate connection, and between the intermediate connection and the second end of the voltage divider. Connecting diodes in series increases the effective breakdown voltage for the series of diodes, taken together. The (or each) diode may comprise a Zener diode. Zener diodes are configured to have a controlled breakdown voltage, and to allow current through the device to keep the voltage across the diode at the Zener (or breakdown) voltage.

According to a second aspect of the invention, there is provided a semiconductor device comprising the semiconductor structure according to the first aspect of the invention, wherein the semiconductor structure is configured as: a high voltage Zener diode, or a high voltage clamp. Embodiments of the first aspect are particularly suitable for providing a high voltage Zener diode or high voltage clamp.

According to a third aspect of the invention, there is provided an electronic apparatus comprising the semiconductor device according to the second aspect.

The apparatus may comprise an integrated circuit for discharging a mains filtering capacitor, and the semiconductor device according to the second aspect may be configured to protect the integrated circuit from overvoltage damage due to mains surge. The semiconductor device may be integrated on a single die with the integrated circuit for discharging the mains filtering capacitor, thereby providing a lower cost solution than protecting such a device using an external component, such as a metal oxide varistor. Any integrated circuit that needs to be protected from high voltages may include a semiconductor device according to the second aspect, for instance configured as a voltage clamp.

According to a fourth aspect of the invention, there is provided a method of fabricating the device according to the first or second aspect of the invention, comprising: providing a semiconductor layer; defining a first and second semiconductor region of the semiconductor layer by forming a voltage isolator around a perimeter of the second semiconductor region, separating it from the first semiconductor region, the voltage isolator comprising a nested series of isolating regions, with an intermediate region of the semiconductor layer between each adjacent pair insulating regions; defining a voltage control device comprising a conducting element connected to at least one intermediate semiconductor region, in parallel with at least one insulating region, so as to control a voltage across the at least one insulating region.

In some embodiments the method may provide for a low cost, scalable high voltage isolation structure that can be included with minimal process modification to facilitate high voltage functionality in an integrated circuit.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIG. **1** is a schematic layout of a first embodiment, in which the voltage control device comprises a diode;

FIG. **2** is an equivalent circuit diagram of the first embodiment;

FIG. **3** is a schematic layout of a second embodiment, in which the voltage control device comprises a diode connected in parallel with each insulating region;

FIG. **4** is an equivalent circuit diagram of the second embodiment;

FIG. **5** is a schematic layout of a third embodiment in which the voltage control device comprises a resistor connected in parallel with each insulating region;

FIG. **6** is an equivalent circuit diagram of the third embodiment.

FIG. **7** is a schematic layout of a high voltage clamp according to a fourth embodiment of the invention;

FIG. **8** is a first detail view of part of the layout of FIG. **7**, including lines A-A' and B-B';

FIG. **9** is a sectional view along line B-B';

FIG. **10** is a sectional view along A-A';

FIG. **11** is second detail view of part of the layout of FIG. **7**, including line C-C';

FIG. **12** is a sectional view along line C-C';

FIG. **13** is a schematic layout of a voltage isolation structure according to a fifth embodiment;

FIG. **14** is a comparison of the die area consumed by a voltage isolation structure in accordance with an embodiment and a prior art voltage isolation arrangement;

FIG. **15** is a circuit diagram of an electronic apparatus that includes a capacitor discharge circuit, according to a sixth embodiment; and

FIG. **16** is a flow diagram illustrating a method according to the fourth aspect of the invention.

Referring to FIG. **1**, a semiconductor structure **10** is shown, comprising a first semiconductor region R**1**, a second semiconductor region R**2**, and a voltage isolator **11** separating the first and second semiconductor region R**1**, R**2**. The second semiconductor region R**2** is within the first